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COMPARATIVE EFFICACY OF THREE INSECTICIDES AGAINST COTTON WHITEFLY (*Bemesia tabaci*) UNDER CONTROLLED ENVIRONMENT

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Cotton is an important cash crop, white gold and mainstay in the economy of Pakistan. Sucking insect pests of cotton especially *Bemesia tabaci* is the major threat. The present study was planned to evaluate the toxic effects of three synthetic insecticides i.e. Acetamiprid 20 SP, Buprofezin 25WP and Endosulfon 35EC against *Bemisia tabaci* against cotton white fly under optimum laboratory circumstances. All the tested insecticides were applied at dose rates of 50, 100, 200, 400 and 800 ppm. Each treatment and control were replicated thrice. Findings of the bioassays displayed that Buprofezin 25WP exhibited high mortality (82.13%) of white fly after exposure of 24 hours, among the three tested insecticides. Whilst Endosulfon 35EC and Acetamiprid 20 SP exhibited relatively low mortality (77.46 and 69.52%, respectively). LC_{50} values reflected that Endosulfon 35EC showed the highest toxicity against *Bemisia tabaci* with LC_{50} of 241.76 ppm followed by Buprofezin 25WP and Acetamiprid 20 SP with LC50s of 340.50 ppm and 395.12 ppm, respectively. Overall results disclosed that all three tested insecticides showed enhanced control under controlled experimental conditions. Hence, Buprofezin and Endosulfon can be used in integrated pest management (IPM) of *B. tabaci*.

Keywords: Bioassays, exposure, mortality, synthetic insecticides, toxic effects.

INTRODUCTION

Cotton is an important cash crop and mainstay in the economy of Asian countries. Owing to worldwide economic importance, this crop is known as 'white gold' and 'silver fiber' in Pakistan and plays a major role in the national economy by contributing 21% in total GDP. The country ranks 4th in cotton production after three main producers i.e. USA, China and India. It is mainstream of large amount of foreign exchange and contributed about 2.9% of GDP and about 11.7% of value added in agriculture. It also shares about 69.5% of contribution in national oil production (Aslam *et al.,* 2003) but unfortunately per acre yield is low due to the many factors among which the insect attack remains a major reason. In Pakistan, cotton is facing a major decline in production during the last few decades due to increased prevalence of sucking pests and subsequently the huge costs spent on their control using pesticides (Khatry, 2008). This crop is damaged by 145 species of insect pests that causes 30 percent reduction in cotton yield in Pakistan. (Rashid *et al.,* 2012). A wide variety of sucking insect pests (up to 96%), Particularly jassid (*Amrasca biguttula*), (*Bemesia tabaci*), aphids (*Aphis gossypii*), dusky cotton bug (*Dysdercus koinigi*) and mealybug (*Phenacoccus solenopsis*) attack on different phases of crop growth due to enrich of greenish leaves. Sucking insect pests and cotton boll worms caused up to 50-60 percent decrease in cotton production (Mohan and Katiyar, 2000; Rajput *et al.,* 2017).

History of cotton whitefly, *Bemesia tabaci* infestation is very old i.e. earlier than the introduction of modern insecticides. Many agricultural crops are infested by this polyphagous insect. It is cosmopolitan in distribution and along with the direct damage to crop (Arif *et al.,* 2006). It constraints photosynthetic activity and impairs quality of cotton fiber (Akram *et al*., 2013). It also carries vector of various well-known viral diseases of several economic crops (Razaq *et al.,* 2003). Cotton white fly causes significant losses to cotton by sucking the cell sap from the lower side of leaves and secretes honeydews on which sooty mold develops which interferes with plant photosynthesis ultimately reducing the plant vigour and yield. Furthermore, it is believed that adults of whitefly also serve as the vector of viral disease in cotton (Nadeem *et al.,* 2011). Among different control measures against sucking pests, the use of chemical pesticides for the control of insect pest is quick and is commonly in practice for integrated pest management (IPM) of crop (Aheer *et al.,* 2003; Mohammad *et al.,* 2008; Iqbal *et al.,* 2013). But due to continuous use of these conventional insecticides in cotton, *B. tabaci* has developed resistance at different level. Resistance in whitefly against insecticides has increased the cost of production owing to increase in number of sprays (Khattak *et al.,* 2004; Ahmad *et al.,* 2010).

An integrated approach should be adopted to control the population of mealy bug. This may include the removal and the subsequent destruction of the diseased plants, eradication of its alternate hosts, efficient water and fertilizer application. Many researchers in the past have evaluated different insecticides to test their comparative toxicity against this insect pest under different environmental conditions (Razaq *et al.,* 2003). Arif *et al.* (2004) conducted experiments by using buprofezin in comparison with some eco-friendly substances against whitefly in cotton under field environment. Razzaq *et al.* (2003) have studied the efficacy of five insecticides included diafenthiuron, acetamiprid, imidacloprid, thiame-thoxam and fenpropathrin against whitefly. Qureshi *et al.* (2009) tested Pyriproxyfen against silver leaf whitefly, *Bemisia tabaci* (Gennadius). Ahmad *et al.* (2002) found that *B. tabaci* have developed resistance to organophosphate and pyrethroid insecticides in Pakistan. Aslam *et al.* (2003) checked the toxicity of different insecticides against sucking pests of cotton. Presently, entomologists are in efforts to test and use the new chemistry insecticides against whitefly for its effective control. So, present study was designed to check the comparative toxicity of some synthetic insecticides against *Bemisia tabaci*.

MATERIALS AND METHODS

The research trial was performed at entomological research lab at Punjab Bio-energy Institute, University of Agriculture Faisalabad (UAF), to check the effectiveness of three altered insecticides Acetamiprid 20 SP, Buprofezin 25WP and Endosulfon 35EC against *Bemisia tabaci* against cotton white fly under optimum laboratory circumstances. The research trial was laid out under completely randomized design (CRD) together with control. All the tested were purchased from local pesticide market and laboratory doses (ppm) were prepared from field recommended doses by following formula.

$$\mu l = \frac{\text{Required ppm x water in ml}}{\%Fx10}$$

There were 5 treatment levels for each tested insecticides including control, having 3 repeats each. All the toxicity bioassays were carried using leaf dip technique. Sequential dilutions of each dose of tested insecticide were prepared and leaves cut with leaf disc cutter according to the size of small plastic petri dishes (5 cm), were dipped in the insecticide solution. Treated leaves were then air dried at ambient room temperature. 25 adults of white fly were released per treatment i.e. 5 insects per leaf. The control leaves were dipped in water only. To study the LC50, insect mortality was recorded after 24 hours. Insects showing no movement on pressing them with needle were considered as dead. Corrected mortality was calculated by Abbott's formula (2). LC50 were calculated using Minitab software.

The collected data was analyzed using statistical software, STATISTICA 8.0 and Abott's formula (1925) was used to calculate the mean percent corrected mortality as follow;

$$\text{Corrected Mortality (\%)} = \frac{\text{Mo(\%)} - \text{Mc(\%)}}{100 - \text{Mc(\%)}} \times 100$$

RESULTS AND DISCUSSION

Endosulfon 35EC showed the highest toxicity against *Bemisia tabaci* with LC_{50} of 241.76 ppm followed by Buprofezin 25WP and Acetamiprid 20 SP with LC50s of 340.50 ppm and 395.12 ppm correspondingly (Table 1). Overall results disclosed that all three tested insecticides delivered enhanced control under controlled experimental conditions however the most effective among all was Endosulfon 35EC, statistically. The other two insecticides i.e. Buprofezin 25WP and Acetamiprid 20 SP also displayed good outcomes with respect to percent mortality yet these were relatively less toxic as compare to Acetamiprid 20 SP.

In case of mortality bioassays, Buprofezin 25WP prompted noteworthy toxicity to white fly after exposure of 24 hours, among the three tested insecticides. While, Endosulfon 35EC and Acetamiprid 20 SP exhibited relatively lower mortalities of the bioassayed insect pest. The percent mortality (82.13%) by application of Buprofezin 25WP followed by Endosulfon 35EC (77.46%) and pyriproxyfen (69.62%). Mortality of bioassayed insect pest was found increased with rise in dose rate of the insecticides (Figures 1, 2 & 3).

Our findings concur with Zhang *et al.* (2011) who checked the efficacy of thiamethoxam and imidacloprid seed treatments against *Bemisia tabaci* (Hemiptera: Aleyrodidae). These results are in conformity with those of Qureshi *et al.* (2009) who observed that pyriproxyfen provided better control of *Bemesia tabaci* eggs and adults. These results are close to the findings of Sachin and Kumari (2017) who checked the comparative toxicity of some synthetic insecticides against adult whitefly. Results of the study of Ahmad *et al.* (2002) are also similar to this study who observed that resistance of whitefly to fenpropathrin was generally very low.

Table 1. LC_{50} of three tested insecticides against *Bemisia tabaci*.

Name of insecticides	LC_{50}	Lower Fiducial limit (95%)	Upper Fiducial limit (95%)	Z-value	P-value	Slope±SE	X^2	R^2	d.f
Buprofezin 25WP	340.50	187.41	502.17	6.34	<0.001	6.92±1.10	21.078	0.88	4
Endosulfon 35EC	241.76	204.70	302.56	5.13	<0.001	7.80±0.90	24.321	0.97	4
Acetamiprid 20 SP	395.12	289.32	456.13	5.07	<0.001	8.10±2.10	22.567	0.96	4

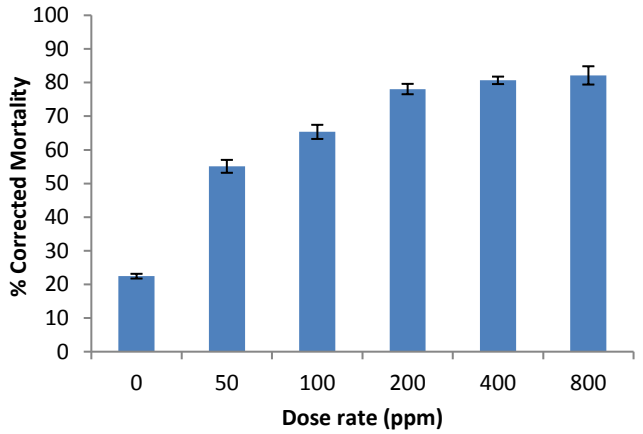

Figure 1. Percent mortality of *Bemisia tabaci* by application of different doses of Buprofezin 25WP.

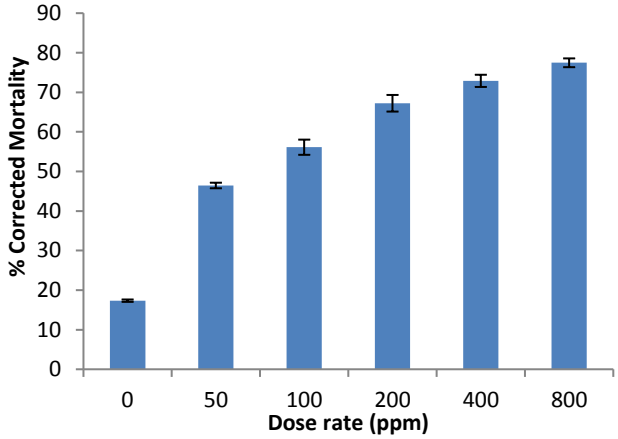

Figure 2. Percent mortality of *Bemisia tabaci* by application of different doses of Endosulfon 35EC.

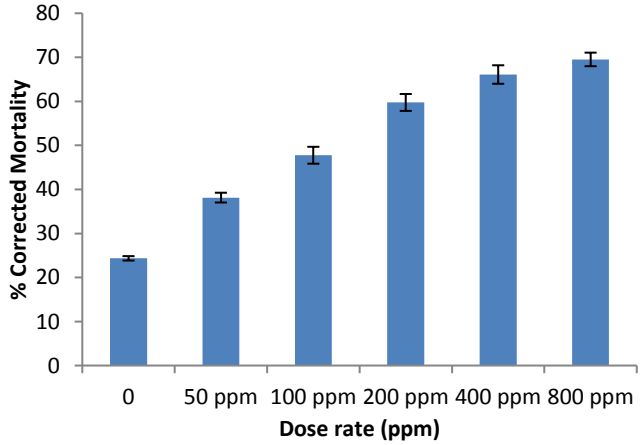

Figure 3. Percent mortality of *Bemisia tabaci* by application of different doses of Acetamiprid 20 SP.

Shivanna *et al.* (2011) also checked the effectiveness of some new insecticides against sucking insect pests including cotton whitefly and noticed increased mortality at higher dose rate as was in my study. Results of increased mortality at higher dose rate are in conformity with Afzal *et al.* (2014) who recorded higher mortality at increased dose rate of the synthetic insecticides. Abbas *et al.* (2012) used imidacloprid, acetamaprid and thiomethoxam against three sucking insect pests of cotton including *B. tabaci* and noticed increased mortality at higher concentration as was recorded in this study. Amjad *et al.* (2009) checked the effectiveness of some synthetic insecticides for the control of *B. tabaci* and recorded higher mortality trend with increased dose rate of the insecticides. However, our results are contradictory with Bi *et al.* (2002) who checked the effectiveness of six novel insecticides for the control of *Trialeurodes vaporariorum*. Contrast in results may be due to difference in synthetic insecticides and test species of whitefly in the both studies. Shaikh and Patel. (2012) checked the toxic effect of some synthetic insecticides and recorded increased mortality as the dose rates of the inscecticides were raised, similar to our study.

Conclusion: It can be concluded from these results that the insecticides used are effective in the substantial control of *Bemisia tabaci* especially Buprofezin and Endosulfon.

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